"EFFECTS OF SOME HEAVY METALS ON TISSUE OF FRESH WATER FISH *LABEOROHITA* OF GODAVARI RIVER NANDED, MAHARASHTRA"

A
Synopsis
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By

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Effects of some heavy metals on Tissue of fresh water fish *labeo rohita* of Godavari River Nanded Maharashtra

1. Introduction:

Pollution is the negative feedback of the environment which affects living organisms. The aquatic environment too is not spared from the adverse effects of pollution. In recent times interest has been focused on rivers and estuaries as these are considered major sources of pollutants of coastal seas andoceans. Human beings have been responsible for marine pollution, as they have introduced directly or indirectly, harmful waste substances into the marine environment.

Estuaries and rivers have not been spared with the result the deleterious effects have paved the way for health hazards to human beings [1]. Industrialization, intensification of agriculture and rapid growth of human population have led to the increased discharge of pollutants which are harmful to the above biotopes.

Metallic contamination in a stream may constitute a danger to public health if the water is to be used subsequently for drinking and other purposes. Increasing concern has been voiced in recent years on the effects of the different heavy metals on the freshwater ecosystems by surface run of either from rain or other sources. Rapid industrialization and urbanization have led to the utilization of heavy metals including mercury on a larger scale.

These metals ultimately enter the aquatic ecosystems directly as effluents or indirectly by precipitation, thereby causing deleterious effects to aquatic life at an alarming level. Trace metals in general have a strong attraction to biological organisms and the slow acclimation of these chemicals in the biological systems, have led to their accumulation in the body tissues, resulting in the stimulation, irritation and inhibition of a variety of body functions.

At present increased food production to meet the energy requirements of the ever increasing population, isa major problem of our country. To meet these requirements man has

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employed modern techniques both in agricultural and industrial production. But at the same time the population explosion possess a great threat to human society.

The organisms inhabiting the marine, estuarine and fresh water environments are exposed to lethal levels of heavy metal pollutants due to industrialization and modern agricultural practices. Some of the heavy metals like iron, copper, manganese, magnesium and zinc are essential for the metabolism of organisms at optimal concentrations but if the concentrations of these metals increase in the environment they may interfere with the metabolic activity in the organisms. The nonessential elements viz., mercury, cadmium,silver and lead are toxic to aquatic organisms even at very low concentrations. Mercury is used in large scale in industries, agriculture, military applications, medicines and dentistry and is considered most toxicamongst the heavy metals.

Mercury in any chemical form has the capability to denature proteins, inactivate enzymes and cause severe disruption in the physiological processes of any tissue with which it may come in contact in sufficient concentration. Mercurial are well recognized neurotoxin and capable of inducingneuronal necrosis.

The main source of freshwater pollution can be attributed to the discharge of untreated waste, the dumping of industrial effluent and the run-off from the agricultural fields. Mercury pollution in aquatic ecosystems has received a great deal of attention since the discovery of mercury as the cause of Minamatadisease in Japan in the 1950s.

Toxicity is influenced by the form of mercury, environmental media, environmental conditions, sensitivityor tolerance of the organism, and its life history stage. The inorganic mercury is less acutely toxic to aquatic organisms than methyl-mercury, but the range in sensitivity among individual species for eithercompound is large. The undesirable effects of heavy metals and other toxic elements has long been recognized for creating havoc in the aquatic and terrestrial environments.

Acute poisoning of aquatic environment leading to ravages of lives occurs from either the occasional industrial and haulage accidents or during routine dumping and unconscious leaching practices. Long term exposure to heavy metals and toxic elements has cataclysmic

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implications to our environment. It may prove to be hazardous and chronic to the animals living in water or associate with it either directly or in a roundabout way.

Indeed, the presence of certain metals like iron, copper, cobalt, calcium and zinc at certain level in theirexploitable forms is essential for life as a source of minerals. The mere presence of metals does not constitute a major threat to fisheries and other aquatic animals' health. But certain metals for instance, mercury, cadmium, silver, lead and arsenic have no nutritive value and are critically idiom as environmental contaminants. With this in view an attempt has been made in the present study to investigate the toxicity impact of heavy metal mercury and zinc.

Fish is often at the top of aquatic food chain and may concentrate large amounts of some metals from thewater. Metal bioaccumulation is largely attributed to differences in uptake and depuration period of various metals in different fish species. Multiple factors including season, physical and chemical properties of water can play a significant role in metal accumulation in different fish tissues.

The gills are directly in contact with water. Therefore, the concentration of metals in gills reflects their concentration in water where the fish lives, whereas the concentration in liver represents storage of metals in water fishes are notorious for their ability to concentrate heavy metals in their muscles and since they play important role in human nutrition, they need to be carefully screened to ensure that unnecessaryhigh level of some toxic trace metals are not being transferred to man through fish consumption.

The present research work aimed to analyze the accumulation of heavy metals in fresh water fish *Labeo rohita* from Godavari River Nanded Maharashtra.

2. Review of literature and development in the subject:

1. Contamination of Mercury in fish and Its Toxicity To Both Fish And Humans: An Overview (Article *in* International Research Journal of Pharmacy · November 2012 by Govind Pandey)

Heavy metals are considered the most important form of pollution of the aquatic environment because of their toxicity and accumulation by marine organisms. The fish may be

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more greatly affected by anthropogenic pollution sources. Fish are highly exposed from the heavy metals, like mercury (Hg), leading to severe toxicity, both in the fish and human beings. The fish accumulate substantial concentrations of Hg in their tissues, and thus the fish are the single largest sources of Hg for humans through fish eating. The organic forms of Hg (e.g., methyl Hg) are more toxic than the inorganic forms due to ease of absorption
into the human system. Communities that relied on fish intake for daily nutrient sustenance may be at risk from chronic, high exposure to methyl Hg, as well as other persistent organic environmental pollutants

2. Toxic effect of mercury on the freshwater fish *oreochromis mossambicus:.*(N. Vasanthi, K. Muthukumaravel, O. Sathick, J. Sugumaran* P.G. and Research Department of Zoology, Khadir Mohideen College, Adirampattinam, Tamil Nadu, India.)

The toxic effect of Mercury on freshwater fish *Oreochromis mossambicus* was studied. The LC50 values of mercury in *O. mossambicus* for 24, 48, 72 and 96 hours were 0.73, 0.69, 0.63 and 0.58 ppm respectively. Tilapia fish was silvery white in body in the control group throughout the experiment. The body color changed from original silvery white to dark color in heavy metal treated fish. The fish maintained in freshwater behaved normal as usual. But when the fish was exposed to mercury, erratic swimming, abnormal posture, dis-balance, sluggishness, imbalance in posture, increase in surface activity, opercula movement, gradual loss of equilibrium and spreading of excess of mucus all over the surface of the body were observed.

1. **3. Analysis of heavy metals in water and fish *cirrhinamrigala* of river godavari, at nathsagar dam in maharashtra, india(**M. J. Shaikh Department of Zoology, Arts, Commerce & Science College, Sonai, Maharashtra, India)

The concentrations of heavy metals (Cd, Cr, Pb, Ni and Zn) in sample water and organs (muscle, gills and liver) of fish *Carrina mrigal* of river Godavari, at Nath Sagar Dam in Maharashtra were analysed. There was an appreciable decrease in metal concentrations in sample water from site I to site II. The heavy metal concentrations in sample water was in the order Ni>Pb>Cd>Zn>Cr. Accumulation of heavy metals in the organs of fish *Cirrhinamrigala* was found in the order gills>muscle>liver. In the gills, lead was found maximum (3.83 µg/g dry weight), whereas chromium was minimum (0.68µg/g dry weight).

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2. **4. Bioaccumulation pattern of zinc in freshwater fish channa punctatus (bloch.) After chronic exposure.** S. Senthil Murugan1 , R. Karuppasamy1,*, K. Poongodi1 , S. Puvaneswari1 1 Annamalai University, Department of Zoology, Annamalainagar 608 002, Tamil Nadu, India.)

The pattern of zinc (Zn) residue in various tissues of Channa punctatus exposed to two treatments of zinc (6.62 and 13.24 mg L−1) for a period of 45 days was analyzed. The concentrations of Zn was found to follow the order of liver > kidney > intestine > gill > muscle. Zn accumulated significantly in all the tissues was studied except muscle tissue. Present findings revealed that liver and kidney are the prime sites of Zn accumulation and zinc load in the muscle was for low as compared to other organs. In the muscles of C. punctatus, 4.95 and 5.29 µg Zn g−1 was accumulated in fish exposed to lower and higher sublethal concentration of Zn at 45th day of exposure, respectively.

5. Effects of zinc exposure on the accumulation, hematology and immunology of

3. **mozambique tilapia, oreochromis mossambicus: .(** Ekrem Şanver Çelik1 *, Hasan Kaya1 , Ekrem Şanver Çelik1 *, Hasan Kaya1 , Sevdan Yilmaz2 , Mehmet Akbulut1 and Arınç Tulgar Sevdan Yilmaz2 , Mehmet Akbulut1 and Arınç Tulgar)

Changes in the hematological and innate immune parameters and accumulation in the liver, gill and muscle tissues were investigated in Mozambique tilapia (Oreochromis mossambicus, L.1758), which were semi-statically exposed to several zinc concentrations in vivo. The fish were exposed to low (1 mg L -1), medium (2.5 mg L-1) and high (5 mg L-1) concentrations of zinc for 14 days. In this study, significant changes were seen in the hematological and innate immune parameters of the fish exposed to zinc in comparison to those of the control group ($p<0.05$). . In all groups exposed to zinc, a decrease in the erythrocyte count (RBC) and lymphocyte percentage and an increase in hemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) values and neutrophile percentage occurred ($P<0.05$). In all groups exposed to zinc, a decrease in phagocytic activity was found, and an increase in lysozyme and myeloperoxidase activities were observed with medium and low concentrations ($P<0.05$).

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3. Aim and objectives of Research / Proposed hypothesis:

- To select the site for collection of fish.
- Collection of fishes season wise.
- Water analysis for determination of different heavy metals.
- Identification and morphometric characters of the fish *labeo rohita.*
- Assessment of reproductive period of the fish *labeo rohita.*
- Assessment of nutritive value of fish *labeo rohita.*
- Tissue collection by dissecting the fish in laboratory, processing for the respected heavy metals.
- To determine the content of heavy metals on the different tissues of the *labeo rohita.*
- Analysis the effects of heavy metals or different tissues of *labeo rohita.*
- Biomagnification of this heavy metals through *labeo rohita* in humans. analysis the effects of heavy metals or different tissues of labeo rohita.
- Biomagnification of this heavy metals through labeo rohita in humans.

4. Methodology to be adopted:

A. For estimation of heavy metals from tissue:

1. Sample Collection

Collect a representative sample of *Labeo rohita* from your study population. Ensure the sample size is statistically significant for accurate estimation.

2. Weigh the Whole Fish

Weigh each fish individually using a sensitive scale, preferably in grams (g), and record their weights.

3. Dissection

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Dissect the fish to separate different tissue types (e.g., muscle, liver, heart, etc.) if necessary for your specific research objectives.

4. Tissue Weighing

Weigh each type of tissue separately using a precise balance. Be sure to record the weight of each tissue type in grams.

5. Statistical Analysis

Perform statistical analysis on the collected data to determine averages, variations, and any relationships between different tissue types or factors of interest.

6. Reporting

Present your findings in a clear and organized manner, including tables and graphs if necessary.

7. Quality Control

Ensure accuracy and reliability of measurements by using calibrated equipment.

B) Water analysis:

Analyzing water for heavy metals is essential for environmental and public health concerns. There are several estimation methods available for the analysis of heavy metals in water. For our research purpose we select- Colorimetric method.

Colorimetric methods involve the use of reagents that form colored complexes with specific heavy metals. The intensity of color is proportional to the concentration of the metal. Examples include the use of reagents like dithizone for mercury and Di thiocarbamates for various heavy metals.

5. Importance of study / society applications:

National and International status:

- *Labeo rohita,* also known as Rohu, is a freshwater fish species that is widely cultivated in India, Bangladesh, and other adjacent countries in the region [1]

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- It is considered the most important among the three Indian major carp species used in carp polyculture systems [1]. The fish is a natural inhabitant of the riverine system of northern and central India, and the rivers of Pakistan, Bangladesh, and Myanmar [1].
- Rohu has high growth potential and is preferred by consumers, which has led to its genetic improvement through selective breeding in India [1].

Labeo rohita, commonly known as Rohu, is a significant fish species in the field of international economics, particularly in South Asia. Here are some key points highlighting its importance and significance:

- Food Security: Rohu is a major source of protein in South Asian diets, especially in countries like India and Bangladesh. Its high protein content makes it an essential component of the diet for millions of people, contributing to food security in the region.
- .Economic Value: The commercial production and trade of Rohu contribute significantly to the economies of South Asian countries. It supports livelihoods of fishermen, fish farmers, and those involved in the fish processing and distribution sectors.
- Exports: Rohu has gained popularity in international markets due to its taste and nutritional value. Exports of Rohu to countries with South Asian diaspora or a demand for ethnic foods generate foreign exchange earnings for the exporting countries.
- Aquaculture: The farming of Rohu has become a lucrative business, and its successful cultivation has led to the growth of the aquaculture industry in South Asia. This contributes to both local and international supply chains.
- Trade Partnerships: The trade of Rohu often involves international trade agreements and partnerships, as countries work together to regulate and facilitate the movement of this fish across borders.
- Economic Diversification: For rural communities in South Asia, Rohu aquaculture offers an alternative source of income and livelihood diversification, reducing dependence on traditional agriculture.

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- Sustainable Practices: The sustainability of Rohu production has gained importance in international economics due to concerns about overfishing and environmental impacts. Sustainable practices are essential to maintain the long-term viability of this industry.
- Research and Innovation: International collaborations and research efforts in aquaculture and fisheries management related to Rohu help improve production efficiency and sustainability.
- In summary, Labeo rohita (Rohu) plays a significant role in international economics by contributing to food security, supporting livelihoods, driving trade, and promoting economic diversification. Its importance extends beyond national borders, as it is exported to meet the demands of global markets. Sustainable management and international cooperation are crucial to harnessing the full economic potential of this fish species.

6. Proposed work plan with tentative chapter scheme /Formulation and structure of thestudy.

- Introduction.
- Review of literature
- Research methodology
- Result and Discussion
- Conclusion
- References

7. Year wise plan of work and target to be achieved.

1st year: -

- Literature survey, collection of fish's samples season wise.
- Analysis of different heavy metals by colorimetric method.
- Identification and morphometric characters of the fish *labeo rohita.*

2nd -year: -

- Identification of nutritive value of fish *labeo rohita.*

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- Tissue collection by dissecting the fish in laboratory, processing for the respected heavy metals.
- To determine the content of heavy metals on the different tissues of the *labeo rohita*.

3rd year

- Analysis the effects of heavy metals or different tissues of *labeo rohita*.
- Biomagnification of this heavy metals through *labeo rohita* in humans.
- Writing, typing and submission of thesis.

8. Expected outcomes:

- It will be new research in the field of fishery science and suggestions to government for theimprovement of aquatic ecosystem.
- In the polluted areas of Godavari river fish contain high concentration of heavy metals like zinc and mercury that effects fish's growth rate, fecundity rate, abnormal behavior, and causes several diseases.
- If human consumption increases on heavy metalated fish then there will be chances for causingdiseases like kidney and immune system failer.
- Heavy accumulation of mercury in body of humans can lead to damage the nervous system and also impact on fetes.

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Research Scholar	Research Guide
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